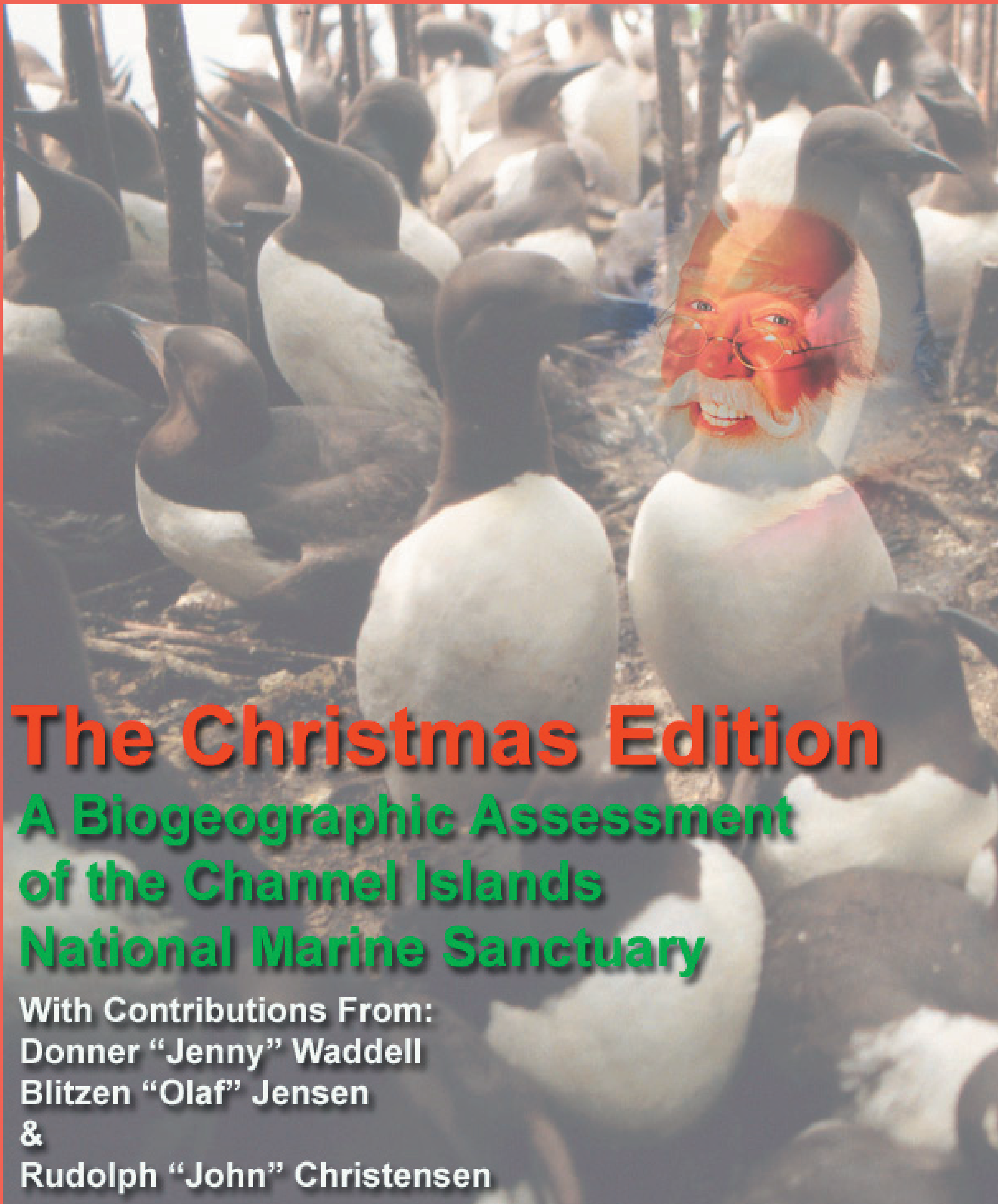
A DRAFT EXAMPLE CHAPTER FOR REVIEW

Marine Bird Diversity



The Christmas Edition

A Biogeographic Assessment of the Channel Islands National Marine Sanctuary

With Contributions From:

Donner “Jenny” Waddell

Blitzen “Olaf” Jensen

&

Rudolph “John” Christensen

Evaluating the Conservation Value of Different Boundary Alternatives

The choice of an appropriate metric for comparison of the different boundary alternatives is a difficult one, and involves implicit value judgments. Since such judgments are policy decisions, and inherently beyond the scope of a biogeographic assessment, we have chosen to present three separate metrics along with a discussion of their biases and implied values. This discussion represents an important "key" for interpreting the summary metrics presented elsewhere in the assessment.

Absolute vs. Relative Metrics

A fundamental distinction can be made between metrics which are based on absolute quantity and those based on relative quantity. Examples of absolute metrics include: the total number of blue whale observations recorded in boundary alternative 5 or the total area of above average bird density falling within the current CINMS boundaries. Examples of relative metrics include: the number of blue whale observations per square kilometer recorded in boundary alternative 5 or the average bird density within the current CINMS boundaries. Although the difference in wording is subtle, under many circumstances the results of absolute and relative metrics can be completely opposite.

Consider a situation (illustrated in Figure 1) in which the area of greatest conservation value is concentrated in one location and that value declines with distance from this center. A set of alternative protected area boundaries exists such that each boundary is centered on the location of highest conservation value, and each successively larger boundary encompasses the smaller alternatives. In this situation, absolute metrics will inherently favor the largest alternative. This is because, for absolute metrics, more is necessarily better (or at least no worse) when the smaller options are a subset of the larger ones. In our hypothetical example, relative metrics will inherently favor the smallest alternative. Since all alternatives are centered on the region of highest conservation value, expanding from the smallest alternative can only add areas of relatively lower conservation value, thus reducing the magnitude of relative metrics such as means or densities. These relationships are illustrated in Figure 2.

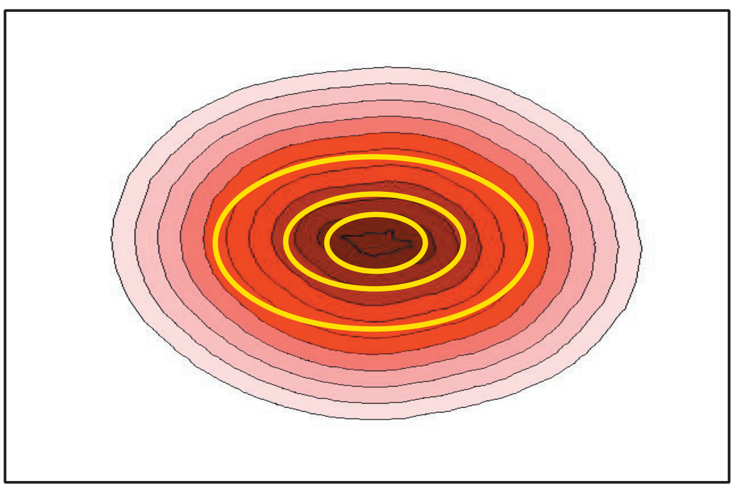


Figure 1. A hypothetical set of three boundary alternatives (yellow lines), and the conservation value (red circles, with darker colors representing greater value) of the area contained within them.

For many of the species and community metrics discussed in this assessment, the hypothetical example above is an apt description of the situation. The current boundary of the CINMS was chosen in part because for many species it encompasses an area of optimal habitat. The smaller boundary alternatives are also generally subsets of the larger alternatives, with all options encompassing the current boundaries. To the extent that each species or community metric matches the hypothetical situation, absolute metrics will be biased toward the larger boundary alternatives and relative metrics will favor the smaller options.

Because of the inherent biases of absolute and relative metrics, we have included a third metric which attempts to provide a more balanced gauge of the relative merits of different boundary alternatives. This third metric (the M-statistic) represents the relative increase in conservation value divided by the relative increase in area compared to the current boundaries. The M statistic is calculated using the formula:

$$M = \frac{(B_1 - B_0 / B_0)}{(A_1 - A_0 / A_0)}$$

where B_1 and B_0 refer to the value of the metric (e.g. sightings, diversity, richness, etc.) within the boundary alternative and the current boundaries respectively, and A_1 and A_0 are the respective areas. In the M-statistic, the

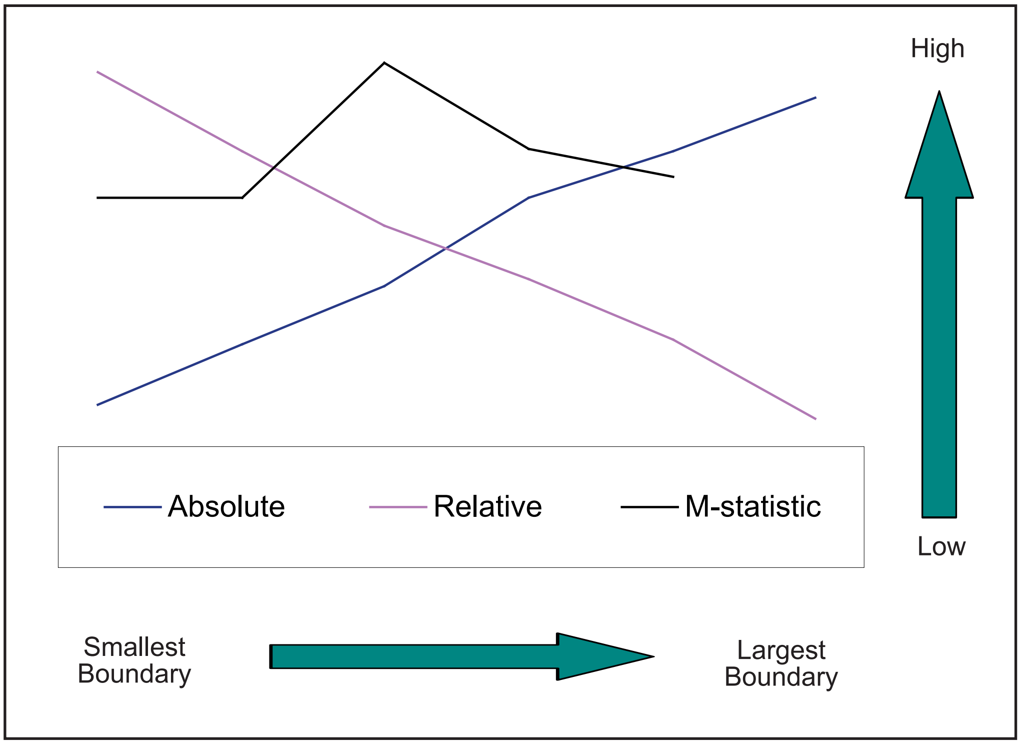


Figure 2. Trend in values of absolute and relative metrics and the M-statistic (re-scaled for display) for the hypothetical example shown in Figure 1.

terms representing the difference in conservation value (numerator) and the difference in area (denominator) are both calculated relative to the current boundaries. This provides some balance against the previously discussed biases, but may not eliminate them entirely.

Marine Bird Diversity

Data

The marine bird diversity data presented in this section are derived from six at-sea surveys (including both marine and aerial platforms) of marine birds from the period 1975 – 1997. The results of these surveys are compiled in the Computer Database Analysis System (CDAS) v2.1 (MMS 2001), and the surveys used in this analysis are summarized in Table 1. Although CDAS contains survey data from the entire US west coast, for this analysis we limited the data to those sightings south of Point Arena. The location of bird sightings and the distribution of survey effort are shown in Figure 3a and b. A total of 95 bird species were observed in the combined surveys (see Appendix 1 for species list). Although some shorebirds are included in the list, these at-sea surveys were not designed to sample shorebirds or nesting colonies.

The Shannon index of diversity (Shannon and Weaver 1949) was chosen for this analysis, because it is one of the most commonly used diversity metrics in community ecology and has relatively small statistical bias when sample sizes are large (as is the case with this source data) (Margurran 1988). The Shannon index attempts to balance species richness (i.e. the total number of unique species) with species evenness (i.e. the distribution of individuals among the species). For a given number of individuals and species, the Shannon index is highest when there is an equal number of individuals of each species.

Since the CDAS data includes summaries for 5-minute of latitude by 5-minute of longitude grid cells, we calculated total observed diversity for each 5-minute cell. The Shannon index (H') was calculated using the formula:

$$H' = -\sum_{i=1}^{s}\left[\left(\frac{n_i}{N}\right)\ln\left(\frac{n_i}{N}\right)\right]$$

where n_i is the number of individuals belonging to the i^{th} species (S) in the sample (5 minute grid), and N is the total number of individuals in the sample (Magurran 1988).

To aid analysis and visual interpretation of the diversity map, the estimated diversity was then interpolated using kriging to provide a statistically smoothed 1km raster surface. To accomplish this, the calculated diversity for each 5-minute cell was first assigned to a point at the center of the cell (i.e. the cell centroid). These point data were subsequently tested for significant spatial autocorrelation using the Moran's I and Geary's C statistics. A finding of significant autocorrelation indicates that points that are nearer to one another tend to have more similar values of diversity than points that are far away (Legendre 1993), and is prerequisite to accurate interpolation. Next, the spatial autocorrelation was described using a variogram, which summarizes the decrease in relatedness between pairs of points as the distance between them increases. The parameters of the variogram were used in a geostatistical interpolation technique known as kriging, which provides a surface of predicted values as well as a standard error surface indicating the regions in which we have higher or lower confidence in the accuracy of estimated diversity. To avoid displaying estimates of diversity in areas where we have little confidence in the prediction, this standard error map was used to clip the diversity surface. The resulting map (Figure 4) displays interpolated bird diversity for those regions where the standard error was in the lowest 25 percent.

The estimated patterns of bird diversity should be interpreted with care, as they represent a compilation of six surveys with different methods occurring over a period of nearly 25 years. The distribution and abundance of some species are known to have changed since 1975 (the earliest data used in this analysis). A drawback common to nearly all diversity metrics, is the strong positive and non-linear (He et al., 1994) correlation between diversity and sampling effort. As sampling effort increases in a given region, the calculated diversity within that region increases as well. Consequently, when sampling effort varies over a given area (as it does within the project study area) some of the observed patterns in diversity may be related to patterns in the distribution of sampling effort. For this reason, we have included a map of sampling effort (Figure 3b) to be considered alongside the map of diversity (Figure 4).

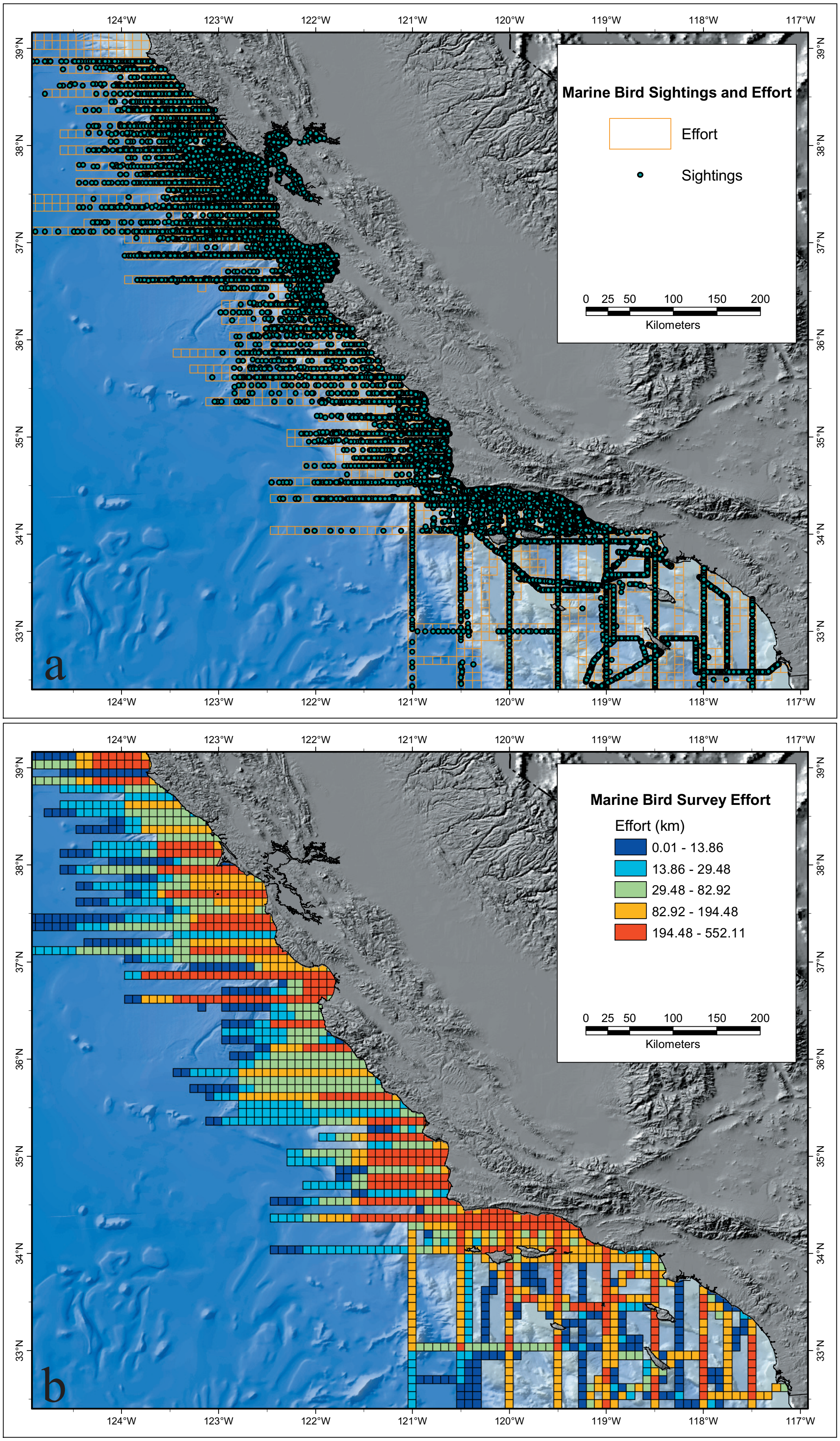


Figure 3. The distribution of marine bird survey effort and sightings (a) and the total amount of effort within five minute of latitude by five minute of longitude grids (b) within the region from Point Arena to the US-Mexico border.

Table 1. Summary of the six surveys that were used in the analysis of marine bird diversity. The information in this table reflects the data used in this analysis, which in some cases may be a temporal and geographic subset of the entire survey.

Survey	Dates	Platform	Months	Total sightings	Total individuals
Minerals Management Service Aerial Surveys	1980-1983	airplane (low altitude)	Year-round	28525	91298
California Department of Fish and Game, Office of Spill Prevention and Response	1994-1997	airplane (low altitude)	Year-round	7751	71151
Southern California Bight Low Aerial Survey	1975-1978	airplane (low altitude)	Year-round	4250	17741
Seabird Ecology Study	1985	ship and airplane	March and May	2212	8641
Southern California Bight Ship Survey	1975-1978	ship	Year-round	17693	58719
Southern California Bight, Minerals Management Service Survey	1995-1997	airplane (low altitude)	Year-round	9780	46199

Large Scale Patterns

The marine bird diversity model resulted in several meso-scale patches (tens to hundreds of kilometers in size) from Point Arena in the north to the US-Mexico border in the south. Regions of high estimated diversity (warm tones) appear along the entire stretch, with a large patch extending from the shelf waters north of Cordell Bank National Marine Sanctuary through the Gulf of the Farallones and Monterey Bay National Marine Sanctuaries along the shelf break terminating in the region of Monterey Bay and Point Sur (Figure 4). A second conspicuous area of high estimated diversity appears approximately 140 kilometers west of Monterey Bay in the open waters over the Guide seamount. Farther to the south another much smaller patch of high diversity appears in the vicinity of the Santa Lucia Banks. This small patch appears to be a seaward extension of the most prominent extent of high diversity, which ranges from Moro Bay in the north along the shelf down to Point Conception. This significant feature then spreads throughout the entire Southern California Bight (SCB), with concentrations around the Channel Islands (San Miguel, Santa Rosa, Santa Cruz, and Anacapa, Santa Catalina, and San Clemente Islands), the Santa Barbara Channel, and shelf areas throughout the southern portion of the Bight.

In general, model results indicate that the current arrangement of National Marine Sanctuaries along the California coastline captures substantial areas of high estimated diversity. In this analysis (ranging from 39^{o} to 32^{o} north latitude), the total area represented by the top 25% of the estimate (Figure 4, stippled area) was 33,881 km^2. Roughly 5,770 km^2 (17%) of this overall area is contained within the four California Sanctuaries, with 6% falling inside the boundaries of the Channel Islands National Marine Sanctuary. A total of 61% of the area contained within current CINMS boundaries was classified as having high marine bird diversity. This is the largest proportion of any California Sanctuary.

More than 195 species of birds occupy coastal and/or offshore aquatic habitats in the SCB (McGinnis 2000). Although many of these species are widely distributed along the west coast, the area of upwelling off Point Arguello/Conception has long been discussed as a key attraction for many of the region's seabird species (Briggs et al. 1987). The convergence of two distinct water masses, coupled with elevated productivity associated with upwelling attracts birds typical of both cool temperate and warm subtropical waters, and contributes to the diversity of the bird community (Baird 1993).

These linkages between oceanographic character, marine biological productivity, and bird populations have been a topic of considerable study (Ainley and Boekelheide 1990, Ainley et al., 1995, Roemich and McGowan 1995, Sydeman *et al*. 1997, Schoenherr *et al*., 1999). Upwelling in the SCB has been correlated to relatively high concentrations of krill and secondary consumers offshore from the northern Channel Islands. In turn, these pelagic invertebrates and forage fishes attract seabirds to the open ocean over the continental shelf around the Channel Islands. Sooty shearwaters (*Puffinis griseus*), which are among the most numerous seabirds in the

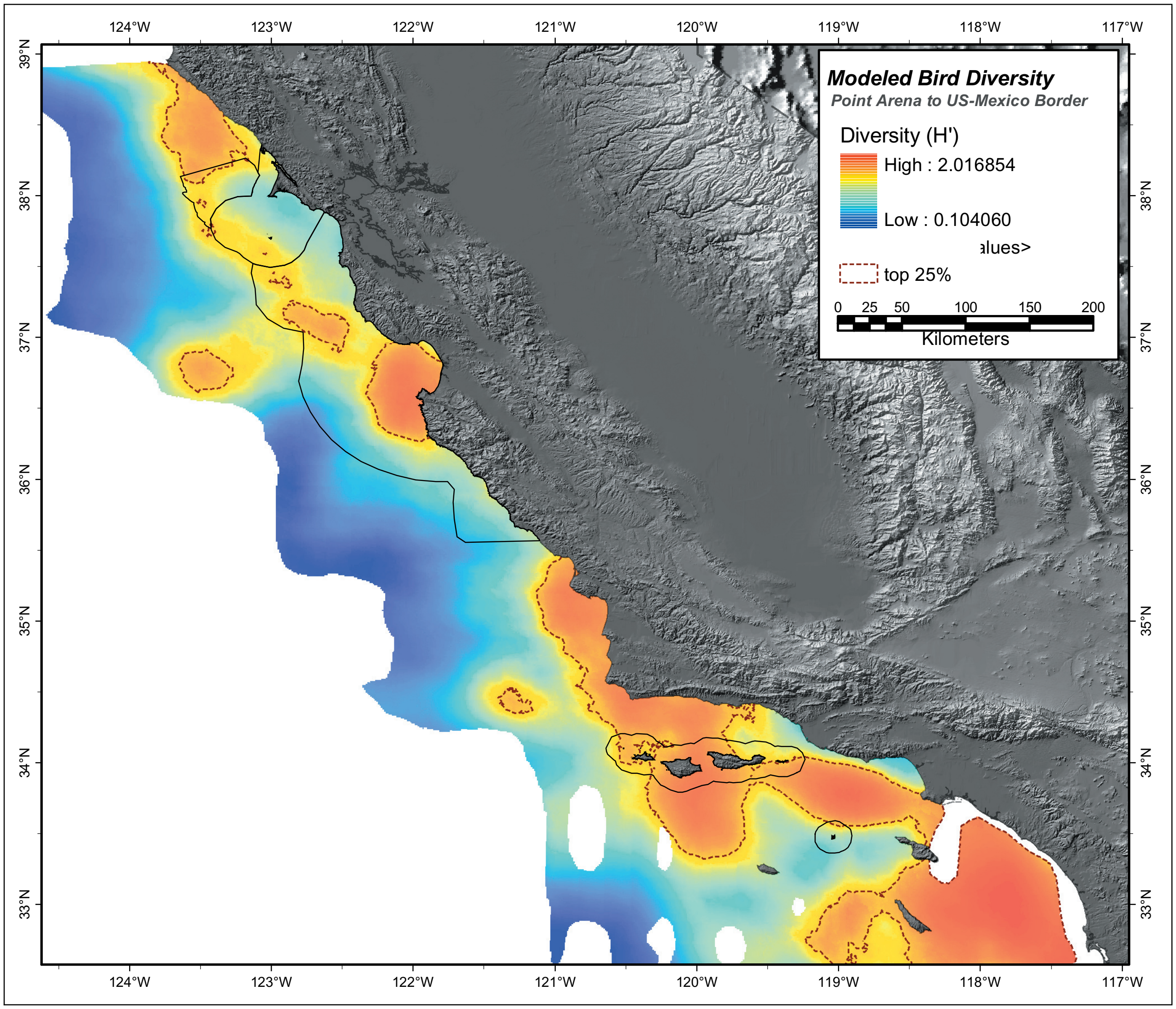


Figure 4. Estimated avian diversity from Point Arena, California, to the US-Mexico border. Stippled areas delineate zones representing the top 75th percentile of the estimate.

study area, forage on fish, squid, and euphausiids (Chu 1984). Shortbelly rockfish, anchovy, and sardine are among the primary foods of common murres (*Uria aalge*), Brandt's cormorants (*Phalacrocorax penicillatus*), and rhinoceros auklet chicks (*Cerorhinca monocerata*). Murres and other seabirds feed principally on euphausiids in the spring, before juvenile fish and anchovies are available (Ainley 1990, 1995). California brown pelicans (*Pelecanus occidentalis californicus*) feed primarily on northern anchovy, Pacific sardine, and Pacific mackerel. Cassin's auklets (*Ptychoramphus aleuticus*) depend on euphausiids and mysids as their primary food supply (Sydeman *et al*. 1997). Rhinoceros auklets and ashy storm-petrels (*Oceanodroma homochroa*) frequent waters of the continental slope, where they feed on euphausiids, oceanic squid, and fishes, including lanternfishes and Pacific saury. Adult rhinoceros auklets are also known to consume sablefish and juvenile lingcod found in deep waters far offshore (Airame *et al*. 2000).

While these trophic linkages do not explain all of the diversity model results, they do corroborate many of the emerging patterns. Each of the high diversity areas identified in the results section occurs near well known upwelling centers (Huyer and Kosro 1987, Brink and Cowles 1991, Kelly 1985, Breaker and Mooers 1986, Breaker and Gilliland 1981, Tracy 1990, Schwing et al. 1991, Breaker and Broenkow 1994, Rosenfeld et al. 1994), including the area near Point Arena, the area near Point Año Nuevo, the nearshore waters directly adjacent to Point Sur, and, as described above, the area of upwelling near Point Arguello/Conception.

Another likely contributing factor in the expression of patterns of bird diversity is proximity to nesting sites. The Farallon Islands are the most important area for nesting seabirds along the California coast and offshore islands/ rocks (Airame 2003). Over 300,000 adult birds nest on the islands in May, which represents the height of the breeding season. Twelve species of seabirds, including common murre, Cassin's and rhinoceros auklets, pigeon guillemot, tufted puffin, western gull, cormorants (double-crested, Brandt's, and pelagic), ashy and Leach's storm-petrels, and black oystercatcher, breed on the Farallon Islands (Ainley and Boekelheide 1990, Schoenherr et al., 1999). This concentration of individuals and species likely influences the broad band of relatively high diversity south and seaward of the Farallones. Most of the remainder of the California populations of these species nest on the Channel Islands -- again an indication that the presence of nesting sites may be affecting the diversity estimate.

Analysis of Boundary Alternatives

The preceding discussion identified a large region of high bird diversity centered on the Channel Islands, ranging from Moro Bay in the north along the shelf down to Point Conception, where it then spreads throughout the entire Southern California Bight (SCB). A total of 61% of the area contained within current CINMS boundaries was classified as having high (top 25%) marine bird diversity – the largest proportion of any California Sanctuary. As such, it is important to note that the no action alternative (NAA, current boundary) is well configured to capture areas of high marine bird diversity; however, a review of the remaining alternatives clearly suggests that an expansion could provide further conservation benefit in terms of preserving areas of high bird diversity. In this section we will use the NAA as a reference point against which the remaining alternatives and analyses will be compared.

Mean estimated diversity for the NAA was calculated to be 1.49 with a coefficient of variation (CV) of 8.8%. Mean diversity and CV values for the remaining alternatives, ranging from smallest in size to largest are as follows: Alternative 5 – 1.49, 8.7%; Alternative 4 – 1.52, 9.9%; Alternative 3 – 1.53, 9.8%; Alternative 2 – 1.50, 10%; Alternative 1a – 1.37, 20.3%; Alternative 1 – 1.38, 20.4%. Mean diversity for the study area boundary (defined in McGinnis 2000) is estimated to be 1.49 with a CV of 9.9% (Figure 5, also see Table 2.) As discussed in the section describing absolute versus relative metrics (Page 2), results shown here are generally predictable, with a trend of larger areas exhibiting lower mean diversity values than smaller ones. This trend is graphically represented in Figure 6 as a linear regression function between area (km^2) and mean diversity (R^2 = 0.60, P = 0.02). It should be noted; however, that the trend shown in this figure is largely driven by alternatives 1 and 1a, and that while the trend is predictable, alternatives 2, 3, and 4 are higher than expected. This indicates that the boundary configuration for these alternatives disproportionately captures areas of high bird diversity, and that any of these alternatives would be a suitable choice for expansion. Clearly, alternatives 1 and 1a would be a less suitable choice based on mean diversity alone.

The relationship between the absolute areas of high diversity (Figure 4, stippled area) is even more predictable than mean diversity, with larger alternatives containing ever larger areas of high diversity (Table 2). Figure 7 shows the linear regression function between the total area (km^2) and the area of high diversity contained within each alternative (R^2 = 0.91, P < 0.01).

Table 2. Mean diversity, high diversity count (m^2), total area, and M-statistics for each boundary alternative.

Alternative	Mean Diversity	High Diversity Count	Area (km^2)	Delta Mean	Delta Count	Delta Area	Count M Equation	Mean M Equation2
Alternative 1	1.375	10608	23013	-7.407407	359.82	513.67	0.70	-0.7139
Alternative 1a	1.372	10572	23094	-7.609428	358.26	515.84	0.69	-0.7303
Alternative 2	1.502	9052	14249	1.1447811	292.37	279.98	1.04	0.2024
Alternative 3	1.53	6763	9563.6	3.030303	193.15	155.03	1.25	0.9677
Alternative 4	1.523	5863	8502.1	2.5589226	154.14	126.72	1.22	0.9997
Alternative 5	1.487	3119	5051.4	0.1346801	35.20	34.70	1.01	0.1921
No Action	1.485	2307	3750	0	NA	NA	NA	NA
Study Area	1.489	9954	17115	0.2693603	331.47	356.40	0.93	0.0374

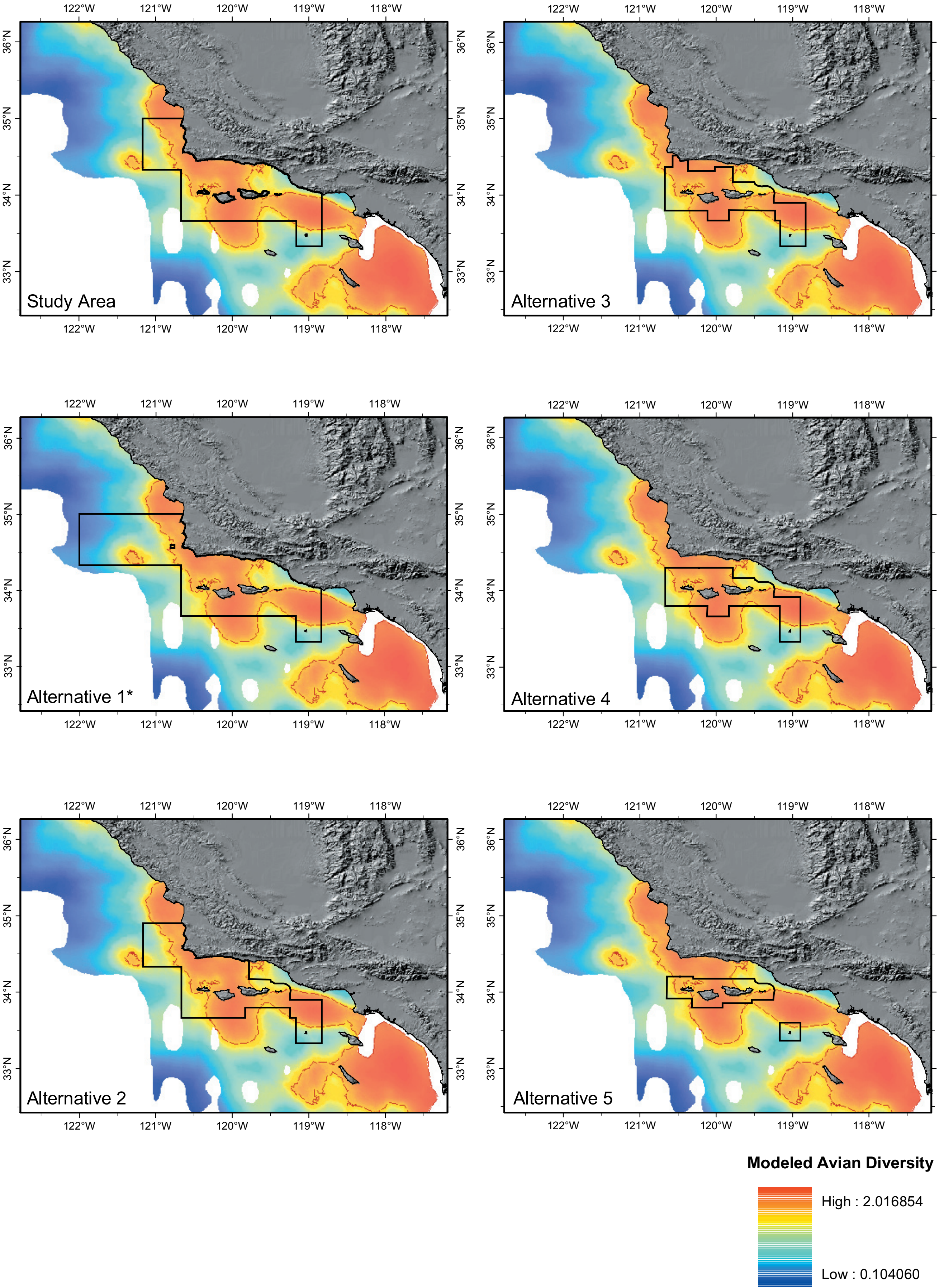


Figure 5. Overlay of estimated avian diversity and CINMS boundary alternatives. The "study area" (upper left) is not an alternative currently under consideration, but is analyzed to provide a point of comparison to the McGinnis report. Alternative 1 is shown with the 'cutout' and is to be used as a representative map for both alternatives 1 and 1a.

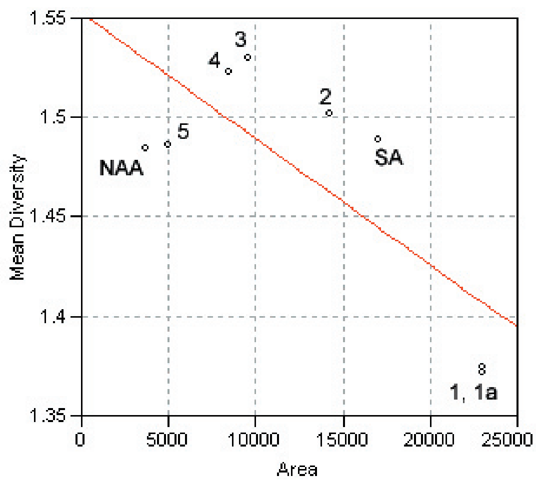


Figure 6. Regression of mean diversity and area. Numbers indicate alternatives, and NA="No Action", SA="Study Area".

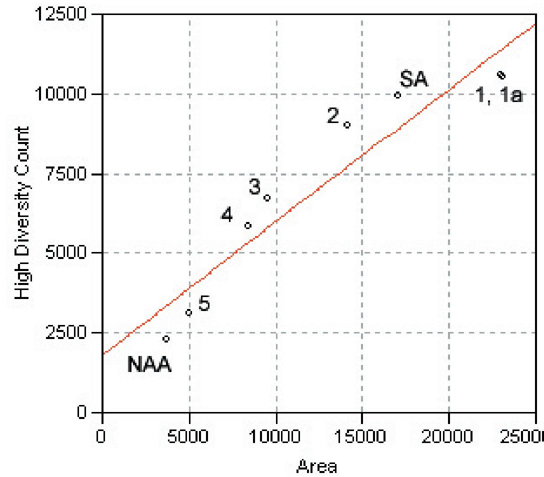


Figure 7. Regression of high diversity area (scaled to count) and alternative area. Numbers indicate alternatives, and NA="No Action", SA="Study Area".

A more balanced metric to use in assessing the relative conservation value for bird diversity is the M-statistic (Table 2, see discussion on Page 3). While this metric decouples the predictable relationships between alternative area and conservation value to some extent, results of the M-statistic are still dependent upon the input data – absolute vs. relative measures. As such, we've provided results of the M-statistics for both mean and absolute bird diversity. Again, the M-statistic takes into account the proportional (%) change in diversity as you step from the NAA to each of the alternatives under consideration. It also incorporates the proportional change (%) in area from the no action.

In both cases, the M-statistics indicate that alternatives 3 and 4 provide the largest conservation value per area gained (Figure 8, table 2). Because the mean M-equation incorporated a negative value in the numerator for alternatives 1 and 1a (decreased mean diversity), the calculated value is necessarily negative. Likewise, because the absolute count of high diversity area always increases with each alternative, the M values are positive.

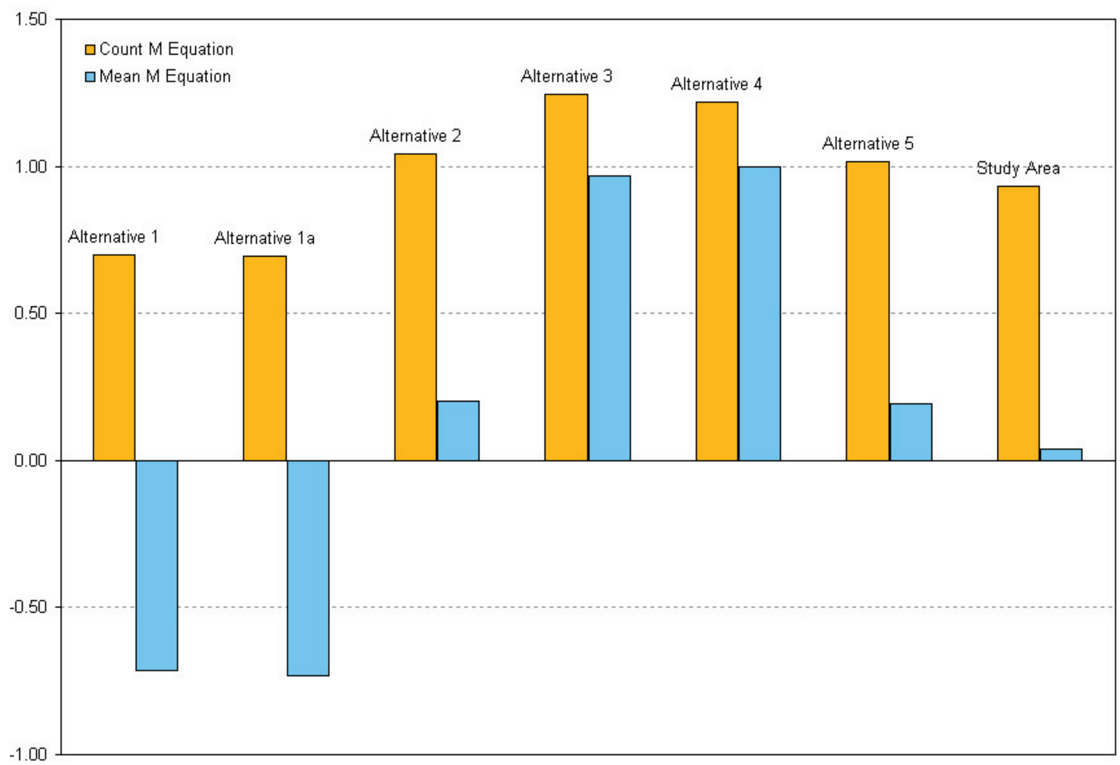


Figure 8. Histogram of the count and mean M-statistics.

Summary

- Patterns of marine bird diversity appear to reflect the distribution of known upwelling regions and areas of high productivity.
- The current boundaries of the CINMS encompass a region of high bird diversity.
- Of the five boundary alternatives being considered in addition to the NAA, options 3 and 4 provide relatively large increases in mean bird diversity within Sanctuary boundaries for their size.

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Appendix 1. Bird Species Included in this Biogeographic Assessment.

Common Name	Scientific Name	Total Observed	Minimum Latitude	Maximum Latitude
Albatross, Black-footed	Diomedea nigripes	364	32.4202	49.9225
Albatross, Laysan	Diomedea immutabilis	7	32.4223	47.6745
Auklet, Cassins	Ptychoramphus aleuticus	14259	32.3334	49.92225
Auklet, Rhinoceros	Cerorhinca monocerata	6774	32.3334	49.83974
Avocet, American	Recurvirostra americana	80	38.07696	38.13767
Booby, Brown	Sula leucogaster	2	32.8819	32.8819
Booby, Masked	Sula dactylatra	1	32.625	32.625
Brant, Black	Branta nigricans	66	32.6313	35.1584
Bufflehead	Bucephala albeola	266	37.53865	38.11572
Canvasback	Aythya valisneria	998	37.45248	38.13816
Cormorant, Brandts	Phalacrocorax pencillatus	3267	32.3631	47.4111
Cormorant, Double-crested	Phalacrocorax olivaceus	77	32.5182	38.01207
Cormorant, Pelagic	Phalacrocorax pelagicus	132	32.6417	48.1996
Dove, Rock	Columba livia	5	38.0772	38.0772
Duck, Red-breasted Merganser	Mergus serrator	8	35.2	38.2833
Duck, Ring-necked	Aythya collaris	40	38.09718	38.11889
Duck, Ruddy	Oxyura jamaicensis	117	38.01797	38.1394
Egret, Common or Great	Casmerodius albus	4	38.05021	38.1167
Egret, Snowy	Egretta thula	4	37.65387	38.12275
Frigatebird, Magnificent	Fregata magnificens	1	33.7482	33.7482
Fulmar, Northern	Fulmarus glacialis	3930	32.3334	49.92291
Godwit, Marbled	Limosa fedoa	120	33.5759	38.14019
Goldeneye, Common	Bucephala clangula	94	38.0187	38.12447
Goose, Canada	Branta canadensis	34	34.8247	38.11551
Grebe, Eared	Podiceps nigricollis	25	32.5833	41.0333
Grebe, Horned	Podiceps auritus	1	37.90353	37.90353
Grebe, Western	Aechmophorus occidentalis	20176	32.6606	48.2067
Guillemot, Pigeon	Cepphus columba	202	32.925	49.49997
Gull, Bonapartes	Larus philadelphia	8013	32.3334	48.3887
Gull, California	Larus californicus	20201	32.3334	49.91972
Gull, Glaucous-winged	Larus glaucescens	361	32.385	49.92023
Gull, Heermanns	Larus heermanni	3176	32.4156	46.83412
Gull, Herring	Larus argentatus	2982	32.3334	48.3968
Gull, Mew	Larus canus	185	33.1013	41.5333
Gull, Ring-billed	Larus delawarensis	19	33.7619	45.66717
Gull, Sabines	Larus sabini	435	32.5816	49.91972
Gull, Thayers	Larus thayeri	1	32.641	32.641
Gull, Western	Larus occidentalis	36845	32.3334	49.61852
Gull, Western x Glaucous-wing	[Hybrid gull]	1	36.7804	48.50529
Heron, Great Blue	Ardea herodias	8	32.5833	38.00079
Jaeger, Long-tailed	Stercorarius longicaudus	10	32.439	49.91972
Jaeger, Parasitic	Stercorarius parasiticus	35	32.4359	49.91972
Jaeger, Pomarine	Stercorarius pomarinus	1444	32.3334	49.91972
Kittiwake, Black-legged	Larus tridactyla	5408	32.3334	49.91972
Loon, Arctic or Pacific	Gavia arctica or pacifica	3230	32.3334	48.3891
Loon, Common	Gavia immer	106	32.6612	48.2017
Loon, Red-throated	Gavia stellata	284	33.925	48.0035

Common Name	Scientific Name	Total Ob-served	Minimum Latitude	Maximum Latitude
Mallard	Anas platyrhynchos	72	37.86668	38.13093
Murre, Common	Uria aalge	34204	32.6371	49.66561
Murrelet, Ancient	Synthliboramphus antiquum	8	34.5333	48.0016
Murrelet, Craveris	Endomychura craveri	6	32.5833	32.925
Murrelet, Marbled	Brachyramphus marmoratus	58	33.6792	49.6539
Murrelet, Xantus	Endomychura hypoleuca	273	32.3334	37.6333
Oldsquaw	Clangula hyemalis	2	38.11587	38.11916
Osprey	Pandion haliaetus	5	37.8542	44.00285
Pelican, Brown	Pelecanus occidentalis	6283	32.3334	46.9146
Pelican, White	Pelecanus erythrorynchos	4	32.906	37.87445
Phalarope, Red	Phalaropus fulicarius	2139	32.3334	49.91674
Phalarope, Red-necked (Northern)	Phalaropus lobatus	1090	32.4182	49.66644
Pintail, Northern	Anas acuta	156	33.7701	38.1285
Puffin, Horned	Fratercula corniculata	13	34.3667	47.9986
Puffin, Tufted	Lunda cirrhata	39	33.5028	49.87408
Redhead	Aythya americana	7	38.03023	38.06582
Sanderling	Calidris alba	7	37.8153	37.8153
Scoter, Surf	Melanitta perspicillata	23392	32.5833	48.2024
Scoter, White-winged	Melanitta fusca	733	32.925	47.9998
Shearwater, Black-vented	Puffius opisthomelas	1453	34.0126	37.70073
Shearwater, Bullers	Puffinus bulleri	1062	32.4515	48.3898
Shearwater, Bullers x Pink foot	[Hybrid shearwater]	5	33.1013	41.5333
Shearwater, Flesh-footed	Puffinus carneipes	10	32.5833	37.95
Shearwater, Manx	Puffinus puffinus puffinus	236	32.3334	41.8667
Shearwater, Pink-footed	Puffinus creatopus	7047	32.3334	49.92116
Shearwater, Short-tailed	Puffinus tenuirostris	9	32.5833	47.8008
Shearwater, Sooty	Puffinus griseus	77004	32.3334	49.92018
Skua, South Polar	Catharacta maccormicki	31	32.484	49.169
Storm petrel, Ashy	Oceanodroma homochroa	1667	32.6599	41.50081
Storm petrel, Black	Oceanodroma melania	575	32.3334	40.7833
Storm petrel, Fork-tailed	Oceanodroma furcata	55	32.5833	49.84043
Storm petrel, Leachs	Oceanodroma leucorhoa	846	32.3334	49.6679
Storm petrel, Leachs x Ashy	[Hybrid storm petrel]	52	32.5833	41.0333
Storm petrel, Least	Halocyptena microsoma	136	32.5833	33.925
Tern, Arctic	Sterna paradisaea	103	32.4237	49.92028
Tern, Black	Chilidonias niger	2	32.5833	32.5833
Tern, Caspian	Sterna caspia	84	33.5755	47.2101
Tern, Common	Sterna hirundo	172	32.5833	44.14335
Tern, Elegant	Sterna elegans	220	32.5833	41.2833
Tern, Forsters	Sterna forsteri	71	32.5833	40.3667
Tern, Least	Sterna albifrons	22	34.0945	34.1828
Tern, Royal	Sterna maxima	35	32.5833	35.3667
Tropicbird, Red-billed	Phaethon aethereus	20	32.4682	34.1136
Turnstone, Black	Arenaria melancephala	1	32.7	32.7
Turnstone, Ruddy	Arenaria interpres	9	32.6183	32.6183
Whimbrel	Numenius phaeopus	44	32.7621	38.12039
Widgeon, American	Anas americana	53	38.06437	38.12536
Willet	Catoptrophrus semipalmatus	436	33.5833	38.13054